Name: ______________________________ Date: ________________

Polynomial Operations SOLUTIONS (version 30)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -2x^5 + 3x^4 + x^2 - 9x + 10$$

$$q(x) = 3x^5 + x^3 - 5x^2 - 8x + 6$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-2)x^5 + (3)x^4 + (0)x^3 + (1)x^2 + (-9)x^1 + (10)x^0 \\ q(x) &= (3)x^5 + (0)x^4 + (1)x^3 + (-5)x^2 + (-8)x^1 + (6)x^0 \\ q(x) - p(x) &= (5)x^5 + (-3)x^4 + (1)x^3 + (-6)x^2 + (1)x^1 + (-4)x^0 \\ q(x) - p(x) &= 5x^5 - 3x^4 + x^3 - 6x^2 + x - 4 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -2x^2 + 5x - 3$$

$$b(x) = -7x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-2x^2$	$5x$	-3
$-7x$	$14x^3$	$-35x^2$	$21x$
-4	$8x^2$	$-20x$	12

$$a(x) \cdot b(x) = 14x^3 - 35x^2 + 8x^2 + 21x - 20x + 12$$

Combine like terms.

$$a(x) \cdot b(x) = 14x^3 - 27x^2 + x + 12$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 - 16x^2 - 2x - 20 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & -2 & -16 & -2 & -20 \\ -8 & & 16 & 0 & 16 \\ \hline & -2 & 0 & -2 & -4 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 - 2 + \frac{-4}{x+8}$$

In other words, $h(x) = -2x^2 - 2$ and the remainder is $R = -4$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 - 16x^2 - 2x - 20$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (-2)\cdot(-8)^3 + (-16)\cdot(-8)^2 + (-2)\cdot(-8) + (-20) \\ &= (-2)\cdot(-512) + (-16)\cdot(64) + (-2)\cdot(-8) + (-20) \\ &= (1024) + (-1024) + (16) + (-20) \\ &= -4 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = -4$.